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(54) Title: HIGH TEMPERATURE ALLOYS

(57) Abstract: An improved nickel-chromium-iron alloy is provided, which comprises up to about 5 % of hafnium-containing particles. In one embodiment, an improved creep resistant castable oxide dispersion strengthened nickel-chromium-iron alloy comprises up to about 5 % of hafnium, with at least part of the hafnium being present as finely dispersed oxidised particles. Further embodiments of the improved alloy can comprise additionally up to about 15 % by weight aluminium. The alloy is particularly useful in the production of creep resistant tubes and castings, for example, for the petrochemical market.



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# INTERNATIONAL SEARCH REPORT

International Application No

PC 03/04754

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C22C30/00 C22C32/00 C22C19/05

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C22C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, COMPENDEX, PAJ, WPI Data, CHEM ABS Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 050 408 A (FIRTH BROWN LTD) 28 April 1982 (1982-04-28)	1,2,4,6, 8,10, 15-17, 24,26, 27,55,61
A	page 5, line 4 page 4, lines 1-12	3,5,7,9, 11-14, 18-20, 28-48, 51,60
X	US 6 409 847 B2 (KLEEMANN WILLI) 25 June 2002 (2002-06-25) column 1, line 57 - column 2, line 17; table 1	24,55, 60,61
A	claims 1-6	1-20

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

3 March 2004

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29.06.04

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# INTERNATIONAL SEARCH REPORT

International Application No

PC B 03/04754

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 017, no. 259 (C-1061), 21 May 1993 (1993-05-21) -& JP 05 001355 A (KUBOTA CORP), 8 January 1993 (1993-01-08) abstract; table 1 paragraph [0018] paragraph [0014]	24,55, 60,61
A	----- EP 0 391 381 A (KUBOTA KK) 10 October 1990 (1990-10-10) page 5, lines 32-34; example 17; table 1 claims 1-5	1-20
X	----- US 5 851 318 A (KLOEWER JUTTA) 22 December 1998 (1998-12-22) column 5, lines 16-24; examples A-F; table 1	24,55, 60,61
A	column 4, lines 27-30; claims 1--3	1-20
A	----- EP 1 065 290 A (SUMITOMO METAL IND) 3 January 2001 (2001-01-03)	
A	----- JP 52 084135 A (MITSUBISHI HEAVY IND LTD) 13 July 1977 (1977-07-13)	
A	----- DATABASE COMPENDEX [Online] ENGINEERING INFORMATION, INC., NEW YORK, NY, US; LETZIG DIETMAR ET AL: "Screening of NiAl-base Ni-Fe-Al alloys for structural high temperature applications and development of a new Ni-30Fe-10Al-Cr alloy" XP002269246 Database accession no. EIX99484847650 abstract -& Z METALLKD; ZEITSCHRIFT FUER METALLKUNDE/MATERIALS RESEARCH AND ADVANCED TECHNIQUES 1999 CARL HANSER VERLAG, MUNICH, GERMANY, vol. 90, no. 9, 1999, pages 712-721, XP009025297 paragraph [0007]; tables 1,2	
A	----- DATABASE COMPENDEX [Online] ENGINEERING INFORMATION, INC., NEW YORK, NY, US; MITCHELL D R G ET AL: "Kinetic and morphological study of the coking of some heat-resistant steels" XP002269247 Database accession no. EIX94122070345 abstract  -/--	

# INTERNATIONAL SEARCH REPORT

International Application No

PC 03/04754

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	<p>-&amp; J MATER SCI; JOURNAL OF MATERIALS SCIENCE AUG 15 1994 PUBL BY CHAPMAN &amp; HALL LTD, LONDON, ENGL, vol. 29, no. 16, 15 August 1994 (1994-08-15), pages 4357-4370, XP009025377 paragraph [0005]; table 1 -----</p>	
A	<p>US 4 995 922 A (JONGENBURGER PETER) 26 February 1991 (1991-02-26) -----</p>	
A	<p>US 5 712 050 A (GOLDMAN EDWARD HARVEY ET AL) 27 January 1998 (1998-01-27) -----</p>	

# INTERNATIONAL SEARCH REPORT

ational application No.  
PCT/GB 03/04754

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 21, 22, 49, 50, 54, 56, 57  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-20, 24, 26-48, 51, 55, 60, 61

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Continuation of Box I.2

Claims Nos.: 21,22,49,50,54,56,57

The above mentioned claims contain undefined and obscure subject-matter and does not comply with the Rule 6.2(a) PCT.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.



This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20,24,26-48,51,55,60,61

Oxide dispersion strengthened Ni-Cr-Fe alloy, containing Hf as fine oxide particles, at least one carbide forming element other than Cr, Nb, Ti, W, Ta and Zr, having improved creep resistance, carburisation resistance at high temperatures; method of alloy production  
The subject-matter of group 1 concerns the problem of improvement of carburisation and creep resistance at high temperature of Ni-Cr-Fe alloys, which is solved by having fine Hf oxide particles, hence the presence of Hf oxide particles is considered to be the special technical feature.

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2. claims: 23, 52, 53

Ni-Cr-Fe alloy comprising up to 5%Hf-containing particles. It is known to have a Ni-Cr-Fe alloy containing up to 5% hafnium carbide particles (see Partial International Search Report, D2, col. 1, line 45-56; col. 2, l. 14-17). Since these claims do not define alloys containing Hf oxide particles, the special technical feature is absent from these claims.

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3. claims: 25, 58, 59

Ni-Cr-Fe alloy comprising up to 15%Al and up to 5%Hf-containing particles.  
As mentioned above, it is known to have a Ni-Cr-Fe alloy containing up to 5%Hf and its hafnium particles being carbides (see Partial International Search Report D2, col. 1, line 45-56; col. 2, line 14-17).  
The subject-matter of these claims is distinguished by the presence of up to 15%Al in the alloy. The technical effect of Al in the alloy is different to the one of Hf oxide, such that there is no common special technical feature.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PC 03/04754

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			EP 0050408 A1	28-04-1982
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